PATENT ABSTRACTS OF JAPAN

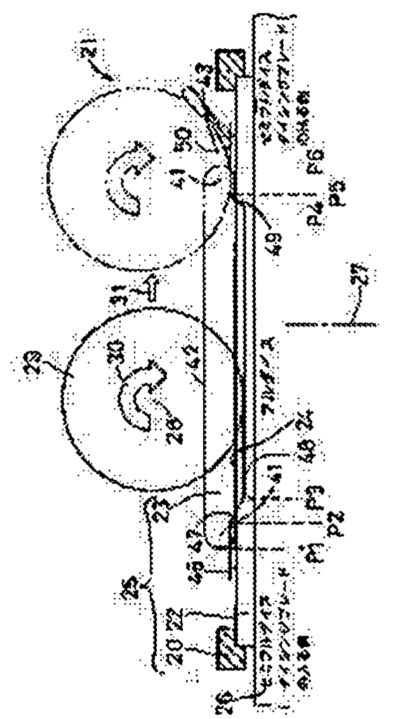
(11)Publication number : 2002-075919
(43)Date of publication of application : 15.03.2002

(51)Int.Cl. H01L 21/301

(21)Application number : 2000-260344
(22)Date of filing : 30.08.2000

(71)Applicant : SHARP CORP
(72)Inventor : KIRIHARA TAKESHI

(54) DICING METHOD OF SEMICONDUCTOR WAFER



(57)Abstract:
PROBLEM TO BE SOLVED: To prevent the peeling of a semiconductor chip 35 and an end piece 36 near a periphery section 33 when dicing a semiconductor wafer 23 attached onto a wafer sheet 22 without increasing the adhesive force of the wafer sheet 22.
SOLUTION: The periphery section 33 of the semiconductor wafer 23 is partially diced in a thickness direction from the surface for setting remaining thickness d2 to 10 to 100 μm. At an inner semiconductor chip formation section 34 surrounded by the periphery section 33, notching is made over the entire thickness direction for cutting. At the periphery section 33, the movement speed of a blade 29 is set faster than that at the semiconductor chip formation section 34 ($v2<v1<v3$), and the flow rate of cutting water is decreased at the periphery section 33 at a downstream side in a movement direction ($q1=q2>q3$).

LEGAL STATUS
[Date of request for examination]
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than

the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] The dicing approach of the semi-conductor wafer characterized by carrying out the dicing of the periphery of the semi-conductor wafer to a wafer sheet selectively in the thickness direction from the front face of a semi-conductor wafer where the rear face of a semi-conductor wafer is stuck, and cutting deeply and carrying out the dicing of the semiconductor chip formation section surrounded by said periphery covering all the thickness directions.
[Claim 2] The dicing approach of the semi-conductor wafer according to claim 1 characterized by carrying out dicing so that the thickness to which said periphery was left behind may be set to 10-100 micrometers.
[Claim 3] The dicing approach of the semi-conductor wafer according to claim 1 or 2 characterized by making passing speed which maintains the rotational speed of a dicing blade at the constant value defined beforehand, and meets the dicing line of a dicing blade more nearly high-speed as more nearly high-speed than the semiconductor chip formation section than the periphery of the migration direction upstream by the periphery of the migration direction upstream at the periphery of the migration direction downstream.
[Claim 4] The dicing approach of the semi-conductor wafer one publication among claims 1-3 which inject cut water towards the cut section of a semi-conductor wafer with a dicing blade, and are characterized by decreasing the flow rate of cut water at the time of the cut of after the cut of the semiconductor chip formation section, and a periphery.
[Claim 5] The semi-conductor wafer structure characterized by being cut deeply and cut covering all the thickness directions in the semiconductor chip formation section which the thickness which the rear face of a semi-conductor wafer was stuck on the wafer sheet, and the cut section was formed along two or more dicing lines, was selectively cut in the thickness direction from the front face in the periphery of the semi-conductor wafer in each dicing line, and was left behind is 10-100 micrometers, and was surrounded by the periphery.
[Claim 6] The dicing table on which the wafer sheet with which the rear face of a semi-conductor wafer was stuck is laid, The dicing blade by which is arranged above a table and revolution actuation is carried out, the migration which carries out the parallel displacement of a table and the dicing blade to the installation side of a table, and carries out contiguity estrangement displacement at right angles to an installation side -- a variation rate -- with a means In the semiconductor chip formation section which carried out dicing in the thickness direction selectively from the front face of a semi-conductor wafer, and was surrounded by said periphery, the periphery of the semi-conductor wafer on a table dicing is cut deeply and carried out covering all the thickness directions -- as -- migration -- a variation rate -- the dicing equipment of the semi-conductor wafer characterized by including the control means which controls a means.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the dicing approach of the semi-conductor wafer which cuts a semi-conductor wafer to the semi-conductor chip size to wish.
[0002]
[Description of the Prior Art] From the former, in manufacturing a semiconductor device, the diffusion process which forms the circuit of a semiconductor device in the front face of a semi-conductor wafer is performed, the process which measures the electrical characteristics of a semi-conductor wafer is performed after that, and it is further supplied to an assembly process after that. The dicing process of a semi-conductor wafer is performed at an assembly process.
[0003] Drawing 6 is the sectional view showing the dicing process of the 1st advanced technology. The rear face (underside of drawing 6) of the semi-conductor wafer 2 sticks, and in this condition, it moves, as shown in the arrow mark 5, carrying out revolution actuation as the arrow mark 4 shows the dicing blade 3, and on the wafer sheet 1 which has adhesiveness, the semi-conductor wafer 2 is deeply cut covering all those thickness directions, and cuts the dicing blade 3 to a region 6 by this on it in the middle of the thickness direction of the wafer sheet 1. The dicing process which cuts all the thickness of the semi-conductor wafer 2 with a blade 3 as shown in drawing 6 is called a full dice method. The condition of having moved in the migration direction 5 of a blade 3 is shown by reference mark 3a. In the downstream of the migration direction 5 of a blade 3, while the nozzle 7 which injects cut water cools the semi-conductor wafer 2 with a mounting eclipse and a blade 3, it commits removing cut waste from the front face of the semi-conductor wafer 2 etc.
[0004] Drawing 7 is the top view of the semi-conductor wafer 2 in the 1st advanced technology shown in drawing 6 . The migration direction 5 of a blade 3 meets the dicing lines 8 and 9 vertical to mutual. The semiconductor chip 10 of the shape of much rectangle in which the slash of drawing 7 is given and shown according to such a dicing process is divided.
[0005] In the 1st advanced technology shown in drawing 6 and drawing 7 , the rate of the migration direction 5 and the flow rate of the cut water from a nozzle 7 are maintained at a respectively fixed value in the infeed depth of a blade 3 along the dicing lines 8 and 9. The blade 3 is rotated at high speed, and the cut water from a nozzle 7 is injected with sufficient vigor, and flows the front-face top of the semi-conductor wafer 2. It is formed in the configuration where beveled from front flesh-side both sides, and the convex curved to the method of outside, in the periphery section 11 of the semi-conductor wafer 2. Therefore, in the downstream which meets in the migration direction 5 of the dicing lines 8 and 9, the piece 12 of an edge of the method of outside [it / in near / periphery section 11 / the semi-conductor wafer 2 / the semiconductor chip 10 and it] separates and disperses from the wafer sheet 1 by the revolution of a blade 3, and injection of the cut water from a nozzle 7. This semiconductor chip 10 and piece 12 of an edge that dispersed collide with a blade 3, and make a blade generate a chip and a crack. It results in a blemish being attached [result] to the semi-conductor wafer 2 by breakage on the chip of this blade 3, a crack, etc., and poor dicing arising [result], and producing the defective of a

semiconductor chip 10. By breakage on a blade, a subsequent dicing process becomes impossible.
[0006] Drawing 8 is the sectional view which other 2nd advanced technology which solves the trouble of the full dice method shown in drawing 6 and drawing 7 simplified. The same reference mark is given to drawing 6 and the part corresponding to the advanced technology of drawing 7 . In this 2nd advanced technology, dicing is selectively carried out in the thickness direction from the front face of the semi-conductor wafer 2, and the thickness d1 which is not cut exists. Such a dicing process is called the semi full dice method whose thickness d1 which is not cut is the divisor of 10 micrometers, and the half dice method a call and whose thickness d1 are 10 micrometers more than 100. In the advanced technology shown in such drawing 8 , among dicing with a blade 3, it is maintained as the semiconductor chip 10 and the piece 12 (refer to drawing 7) of an edge adhered to the wafer sheet 1, and there is an advantage of being hard coming to separate.
[0007] Since the rear face of a semiconductor chip 10 is continuing in the part which has the above-mentioned thickness d1, it is the break process performed after the dicing process in an assembly process, and the new problem of the 2nd advanced technology of drawing 8 needs to fold and divide each semiconductor chip 10 along the dicing lines 8 and 9, at the time of this fragmentation, it is near the part of the thickness d1 of a semiconductor chip 10, and it carries out cleavage. Therefore, the electrical characteristics and dependability of a semiconductor chip 10 fall.
[0008] Other 3rd advanced technology is indicated by the pan which solves the problem of each advanced technology shown in drawing 6 - drawing 8 at JP,5-90406,A.
[0009] Drawing 9 is the top view simplified for explaining the 3rd advanced technology. The same reference mark is given to the part to which the 1st and 2nd advanced technology corresponds. The semi-conductor wafer 2 is cut along with the 1st cutline 15 and the 2nd cutline 16 vertical to it with a blade, and a semiconductor chip 10 and the piece 12 of an edge are obtained. In this advanced technology, the 1st cutline which has the starting point of dicing in a way outside the periphery of a semi-conductor wafer among the 1st cutline 15, and the 2nd cutline which has the starting point of dicing in the circumference circles of the semi-conductor wafer 2 are prepared by turns, and this is vertical to one cutline 15, and also the same about the cutline 16 of a way.
[0010] With such 3rd advanced technology, when a semiconductor chip 10 is comparatively small, or when the piece 12 of an edge is comparatively small, the exfoliation from the wafer sheet 1 in dicing and scattering cannot be controlled, either. Moreover, in this 3rd advanced technology, in case the piece of an edge which has a comparatively large configuration exists, therefore the wafer sheet 1 is pulled and expanded for example, in a subsequent die bond process and mutual spacing of a semiconductor chip 10 is extended, there is also a problem that spacing of semiconductor chip 10 comrades becomes an ununiformity.
[0011] By such big adhesion, although it is possible to increase the adhesion of the wafer sheet 1 in order to prevent a semiconductor chip 10 and the piece 12 of an edge exfoliating and dispersing from the wafer sheet 1, in case a semiconductor chip 10 is demounted and taken up from the wafer sheet 1, by the big force, a semiconductor chip 10 must be pulled, it must exfoliate, and a result which a semiconductor chip 10 damages by this is brought. Moreover, with the configuration using ultraviolet-rays hardenability resin as adhesives with such large adhesion, costs increase and it is inferior to reduction of the cost price.
[0012]
[Problem(s) to be Solved by the Invention] The object of this invention is offering the dicing equipment of the dicing approach of the semi-conductor wafer a semiconductor chip and the piece of an edge exfoliate, and do not disperse from a wafer sheet at the time of dicing, and it was made for a blade not to damage by this, the semi-conductor wafer structure, and a semi-conductor wafer, without increasing adhesion with a wafer sheet.
[0013]
[Means for Solving the Problem] This invention is in the condition which stuck the rear face of a semi-conductor wafer on the wafer sheet, and is the dicing approach of the semi-conductor wafer characterized by carrying out the dicing of the periphery of the semi-conductor wafer in the thickness

direction selectively from the front face of a semi-conductor wafer, and cutting deeply and carrying out the dicing of the semiconductor chip formation section surrounded by said periphery covering all the thickness directions.

[0014] If this invention is followed, using the dicing blade by which revolution actuation is carried out where the rear face of a semi-conductor wafer is stuck on a wafer sheet, the periphery of a semi-conductor wafer will remain without cutting selectively in the thickness direction, therefore cutting a part of thickness direction by the side of a wafer sheet, and will carry out dicing by the semi full dice method or the half dice method in this way. Rather than the periphery surrounded by this periphery, by the semiconductor chip formation section of the inner direction, it cuts deeply covering all the thickness directions, and dicing is carried out by the full dice method. Therefore, it prevents the semiconductor chip 35 and the piece 36 of an edge in near a periphery of a semi-conductor wafer not exfoliating from a wafer sheet, and dispersing by this at the time of dicing with a blade. Therefore, while the breakage which the semiconductor chip or the piece of an edge which dispersed collides, and lacks a blade or is divided into a blade is prevented, the life of a blade can be prolonged, and a semi-conductor wafer is not damaged by such scattering, and productivity, workability, and the yield improve.

[0015] Moreover, a cut can be performed in the piece of an edge near the periphery of a semi-conductor wafer selectively as mentioned above in the thickness direction, therefore the piece of an edge can be folded in it, and it can divide in a comparatively small configuration. Therefore, at the time of amplification of the wafer sheet of the die bond process which continues after a dicing process as stated in relation to the advanced technology of drawing 10, mutual spacing of each semiconductor chip can be mostly made into homogeneity, and an activity can be done good.

[0016] Although the circuit of a semiconductor device does not need to be formed in the periphery, while the semiconductor chip with which such a circuit may be formed and the circuit of a semiconductor device was formed in the semiconductor chip formation section is contained, the piece of an edge in which still such a circuit is not formed may exist. A wafer sheet may have, the adhesion which can exfoliate from a wafer sheet in extent which holds the semiconductor chip by which dicing was carried out and does not damage a semiconductor chip, for example, 2.94N/25mm (300gf / 25mm) extent, of a semi-conductor wafer. As for the periphery section which is a way outside the periphery of a semi-conductor wafer, beveling is performed from front flesh-side both sides, and if this invention is followed even if it has the configuration where the convex curved or inclined in the method of outside and is such a configuration, a possibility of exfoliating from a wafer sheet will not have a semiconductor chip and a piece of an edge at the time of the dicing of the periphery of a semi-conductor wafer.

[0017] Moreover, this invention is characterized by carrying out dicing so that the thickness to which said periphery was left behind may be set to 10-100 micrometers.

[0018] If this invention is followed, the thickness d2 left behind without cutting the periphery of a semi-conductor wafer will be chosen as 10-100 micrometers, and the so-called semi full dice method will perform dicing. By this, fragmentation of the semiconductor chip in the periphery of a semi-conductor wafer and the piece of an edge is easy, and moreover it is the part of said left-behind thickness d2, and can control that the chip by the side of the rear face of a semi-conductor wafer and a crack arise.

[0019] There is a possibility that the piece of an edge of said periphery [thickness / d2 / which was left behind] at the time of dicing may exfoliate from a wafer sheet, and it will be necessary to aim at buildup of adhesion in less than 10 micrometers. If the left-behind thickness d2 exceeds 100 micrometers, at the time of fragmentation of the semiconductor chip in near a periphery, and the piece of an edge, it will become easy to produce the chip by the side of the rear face of the semi-conductor wafer in near the part of the left-behind thickness, and a crack, and the yield will get worse.

[0020] Moreover, this invention is characterized by being the periphery of the migration direction upstream, being the periphery of the migration direction downstream as more nearly high-speed than the semiconductor chip formation section, and making more nearly high-speed than the periphery of the migration direction upstream passing speed which maintains the rotational speed of a dicing blade at the constant value defined beforehand, and meets the dicing line of a dicing blade.

[0021] If this invention is followed, the rate of the migration direction along the dicing line of a dicing

blade, maintaining the rotational speed of a blade at constant value a load with a shallow cut by the small periphery Rather than the large chip formation section of the load cut covering total thickness, it supposes that it is high-speed (it sets to below-mentioned drawing 3 (2), and is v1>v2 and v3>v2), and by this, dicing time amount is shortened and productivity is improved.

[0022] Moreover, if this invention is followed, at the periphery of the migration direction downstream of a blade, passing speed of a blade will be made high-speed (v1<v3), and it will protect certainly that the semiconductor chip and the piece of an edge in near a periphery of the migration direction downstream exfoliate from a wafer sheet from the periphery of the upstream by the adverse effect of the cut water in the configuration which injects cut water to a semi-conductor wafer by this.

[0023] Moreover, this invention injects cut water towards the cut section of a semi-conductor wafer with a dicing blade, and is characterized by decreasing the flow rate of cut water after the cut of the semiconductor chip formation section at the time of the cut of a periphery.

[0024] If this invention is followed, the flow rate of cut water will be made smaller than the semiconductor chip formation section by the periphery in the migration direction downstream of a blade at the time of the dicing of the semi-conductor wafer by migration of a blade (it sets to below-mentioned drawing 3 (3), and is q2>q3). It becomes certain to prevent exfoliation by the cut water injection of the semiconductor chip in near the periphery of the migration direction downstream and the piece of an edge by this.

[0025] Cut water makes low the load of the blade which prevents the temperature rise of the semi-conductor wafer by the cut, and cools, and reduces the cutting force of a blade, and prevents clogging of the cut cutting edge of a blade further, and work of wiping away the cut waste further produced by the cut of a semi-conductor wafer from the front face of a semi-conductor wafer is achieved.

[0026] Moreover, the thickness which the rear face of a semi-conductor wafer was stuck on the wafer sheet, and the cut section was formed along two or more dicing lines, was selectively cut in the thickness direction from the front face in the periphery of the semi-conductor wafer in each dicing line, and was left behind is 10-100 micrometers, and this invention is the semi-conductor wafer structure characterized by being cut deeply and cut covering all the thickness directions in the semiconductor chip formation section surrounded by the periphery.

[0027] In the semi-conductor wafer structure of this invention, since it is selectively cut in the thickness direction from a front face, only the thickness d2 of 10-100 micrometers is left behind and the periphery of the semi-conductor wafer stuck on the wafer sheet is deeply cut in the semiconductor chip formation section of the inner direction covering all the thickness directions rather than the periphery, it can divide the piece of an edge of a periphery along a dicing line, and can make the piece of an edge comparatively small. Where a wafer sheet is followed for example, expanded to a dicing process at a die bond process by this, spacing of a semiconductor chip can be mostly made into homogeneity, and improvement in workability can be aimed at. Such a semiconductor chip of the semi-conductor wafer structure and a piece of an edge of a periphery are easy not to exfoliate from a wafer sheet un-wanting, to be the comparatively small tensile force of extent which does not damage the semiconductor chip from a wafer sheet, and to exfoliate a semiconductor chip from a wafer sheet moreover.

[0028] Moreover, the dicing table on which the wafer sheet with which, as for this invention, the rear face of a semi-conductor wafer was stuck is laid, The dicing blade by which is arranged above a table and revolution actuation is carried out, the migration which carries out the parallel displacement of a table and the dicing blade to the installation side of a table, and carries out contiguity estrangement displacement at right angles to an installation side -- a variation rate -- with a means In the semiconductor chip formation section which carried out dicing in the thickness direction selectively from the front face of a semi-conductor wafer, and was surrounded by said periphery, the periphery of the semi-conductor wafer on a table dicing is cut deeply and carried out covering all the thickness directions -- as -- migration -- a variation rate -- it is dicing equipment of the semi-conductor wafer characterized by including the control means which controls a means.

[0029] If this invention is followed, the dicing activity of a semi-conductor wafer can be continued automatically, without a semiconductor chip and the piece of an edge exfoliating near the periphery of

the semi-conductor wafer.
[0030]
[Embodiment of the Invention] Drawing 1 is the simplified sectional view showing the configuration of one gestalt of operation of this invention. In the dicing equipment 21 of a semi-conductor wafer, the wafer sheet 22 of drawing 1 with which adhesive adhesives were formed in the top front face at least is pasted up on the annular retaining ring 20, the rear face 24 of the semi-conductor wafer 23 is stuck on anchoring and this wafer sheet 22, and the semi-conductor wafer structure 25 is constituted. This semi-conductor wafer structure 25 is fixed to the table 26 which has an installation side level to dicing equipment 21. Beveling is performed from both sides of the rear face 24 and a front face 42, in the method of outside, it curved or the periphery section 41 in the periphery 33 of the semi-conductor wafer 23 has the inclined configuration which is a convex. A table 26 is constituted possible [an angular displacement] 90 degrees at the circumference of the perpendicular axis 27. At the upper part of a table 26, revolution actuation of the blade 29 which has the level axis of rotation 28 parallel to the installation side of a table 26 is carried out at high speed in a hand of cut 30. While both-way migration of the blade 29 is carried out to the migration direction 31 parallel to the installation side of a table 26, and its hard flow at the time of dicing and doing a dicing activity during this migration, it drives so that the semi-conductor wafer 23 can be approached and it can desert in the direction of z which is the vertical direction of drawing 1 . Displacement actuation of the blade 29 is carried out in the direction of z which is the thickness direction (it is perpendicularly to the vertical direction of drawing 1 , and the space of drawing 2 (1)) of the semi-conductor wafer 23 vertical to xy flat surface.
[0031] Drawing 2 is drawing for explaining the actuation which carries out the dicing of the semi-conductor wafer 23 with a blade 29. Drawing 2 (1) is the top view of the semi-conductor wafer 23. The semi-conductor wafer 23 contains the semiconductor chip formation section 34 of the inner direction rather than the periphery 33 which is an annular field, and the periphery 33 surrounded by this periphery 33. In order to make clear each field of these peripheries 33 and the semiconductor chip formation section 34, a slash is given and illustrated in drawing 2 (1). Within the semiconductor chip formation section 34, the semiconductor chip 35 with which the circuit of a semiconductor device was formed of the diffusion process is contained. With a periphery 33, the piece 36 of an edge in which a semiconductor circuit is not formed is further contained in the semiconductor chip formation section 34. The semiconductor chip with which the semiconductor circuit was formed also in the periphery 33 may exist.
[0032] In the x directions 31 which are longitudinal directions of drawing 2 (1), a blade 29 is cut along two or more 1st dicing lines 37, and does a dicing activity. These 1st dicing lines 37 open spacing defined beforehand in the direction of y, and are formed in it. In this way, after two or more dicing activities are done on the semi-conductor wafer 23 along the dicing line 37, the angular displacement of the table 26 is carried out to the circumference of an axis 27 90 degrees, and the dicing activity cut along the 2nd dicing line 38 which extends at right angles to the 1st dicing line 37 is done. The 1st and 2nd dicing lines 37 and 38 begin from the method of outside [periphery / 33 / of a semiconductor chip 23], and are finished with the method of the outside of the migration direction 31 of those 1st and 2nd dicing lines 37 and 38.
[0033] Drawing 2 (2) is drawing showing the passing speed of the migration direction 31 of the blade 29 in alignment with one dicing line 37a of two or more 1st dicing lines 37 which can be set in case the dicing of the semi-conductor wafer is carried out with a blade 29. A blade 29 is driven with a fixed rotational speed to the circumference of the axis of rotation 28 shown in drawing 1 , and the hand of cut 30 is the downstream (method of the right of drawing 1) of the migration direction 31, and it is a direction which enters into the semi-conductor wafer 23.
[0034] A nozzle 43 is arranged and it moves to the downstream (method of the right of drawing 1) of the migration direction 31 of a blade 29 along the dicing lines 37 and 38 with a blade 29. Cut water is injected from a nozzle 43. This cut water is injected from a nozzle 43 by the upstream rather than the cut location of the semi-conductor wafer 23 with a blade 29.
[0035] Drawing 2 (3) is drawing showing the flow rate of the cut water injected from the nozzle 43 at

the time of a blade 29 moving in the migration direction 31 along with dicing line 37a. With cut water, the temperature rise at the time of the cut of the semi-conductor wafer 23 is controlled, and it cools, and the cutting force of a blade 29 is decreased, clogging of the cut cutting edge of a blade 29 is prevented further, and work of wiping away the cut waste of the semi-conductor wafer 23 to the downstream of the migration direction 31 further is achieved.

[0036] In case the dicing of the semi-conductor wafer 23 is carried out along with one 1st blade line 37a with a blade 29, as the lowest edge in drawing 1 of the blade 29 is shown by the reference marks 46-50 of drawing 1 , the variation rate of the blade 29 is carried out in the direction of z. The locations 46-50 of these lowest edges of a blade 29 may show the bottom of the cut slot formed of the blade 29, and may show reference marks 46-50 as a bottom of a cut slot by the following explanation.

[0037] In the periphery 33 of the semi-conductor wafer 23, from the front face 42 of the semi-conductor wafer 23, a blade 29 is selectively cut in the thickness direction (the vertical direction of drawing 1), and carries out dicing to it, therefore the bottom 46 of a cut slot exists in the method of the inside of the thickness direction (upper part of drawing 1) rather than the rear face 24 of the semi-conductor wafer 23. In the semiconductor chip formation section 34 of the semi-conductor wafer 23, the bottom 48 of a cut slot is entered to the thickness direction middle of the wafer sheet 22, therefore the dicing of the semi-conductor wafer 23 is cut deeply, cut and carried out covering all the thickness directions. In the field of the semiconductor chip formation section 34 approach of a periphery 33, the bottom 47 of a cut slot inclines so that it may become deep, as it becomes the migration direction 31 downstream of a blade 29. After the cut of the semiconductor chip formation section 34, by the periphery 33, it becomes shallow as the bottom 49 of a cut slot becomes the migration direction 31 downstream, and after that, it is selectively cut in the same thickness direction as the above-mentioned bottom 46, and a bottom 50 is formed in it by the downstream of the migration direction 31. In this way, other 1st dicing lines 37 and 2nd dicing lines 38 as well as 1st dicing line 37a are also formed.

[0038] Drawing 3 is the sectional view of a vertical seen from cutting plane line III-III of drawing 2 (1). In the periphery 33 of the semi-conductor wafer 23, the bottom 46 of a cut slot is left behind from the rear face 24 of the semi-conductor wafer 23, without cutting only thickness d2. This thickness d2 is chosen as 10-100 micrometers as mentioned above.

[0039] Drawing 4 is the block diagram showing the electric configuration of the dicing equipment 21 of the semi-conductor wafer of one gestalt of operation of this invention shown in drawing 3 . The processing circuit 52 realized with a microcomputer etc. A migration means 54 for the revolution driving means 53 which carries out revolution actuation of the blade 29 at the circumference of an axis 28 to be connected, and to move this blade 29 in x directions and the direction of y of drawing 2 (1) with a nozzle 43, Each displacement means 56 which carries out the angular displacement of the table 26 to the displacement means 55 at the circumference of the vertical-axis line 27 in the height which displaces this blade 29 in the direction of z of drawing 2 (1) is connected. Furthermore, the flow control valve 57 which controls the flow rate of the cut water supplied to a nozzle 43 is connected to the processing circuit 52.

[0040] Drawing 5 is a flow chart for explaining actuation of the processing circuit 52 shown in drawing 4 . Along with one dicing line 37a of the 1st dicing lines 37, dicing actuation is performed in the case of the dicing activity of the semi-conductor wafer 23. It moves from step s1 to step s2, and the field cut with a blade 29 judges whether it is the periphery 33 of the semi-conductor wafer 23 with detection means, such as for example, a location detection device. When it is the location p1 shown in drawing 2 (2) by which the cut of a periphery 33 should be started by the blade 29, in the following step s3, a dicing activity is done by the semi full dice method. Namely, the location of the direction of z is set up by the displacement means 55 in height, and it is moved in the migration direction 31 along with dicing line 37a by the migration means 54 so that thickness d2 may remain [the bottom 46 of a cut slot] from the rear face 24 of a semiconductor chip 23.

[0041] Revolution actuation of the blade 29 is always carried out by the revolution driving means 53 with a fixed rotational speed. A blade 29 progresses in the migration direction 31, and when only the distance beforehand defined rather than the boundary location p3 with the semiconductor chip formation

section 34 arrives at the front location p2, it displaces so that the bottom 47 of a cut slot may become deep gradually in the direction of z about a blade 29 with the displacement means 55 in height. At this time, rather than a location p2, in this side, it is set to the passing speed v1 of the migration direction 31 of the blade 29 by the migration means 54, and is set in less than [rate v] one in the boundary location p3. In this way, in the semiconductor chip formation section 34, it is judged whether the location cut by the blade 29 in locations p3-p4 reached the semiconductor chip formation section 34, and if that is right, in the following step s5, a dicing activity will be done by the full dice method in step s5 from a location p3. At step s5, the blade 29 was cut covering the total thickness of the semi-conductor wafer 23, and the bottom 48 has reached in the middle of the thickness direction of the wafer sheet 22.

[0042] The flow rates q1 and q2 of the cut water supplied through a flow control valve 57 from a nozzle 43 are maintained at a fixed value until a blade 29 arrives at the boundary location p4 of the migration direction 31 downstream of the semiconductor chip formation section 34 along with dicing line 37a.

[0043] It is judged from the location p4 which meets dicing line 37a in step s6 of drawing 5 whether the periphery 33 was reached again, and if that is right, in step s7, a dicing activity will be done by the semi full dice method. At this time, by the periphery 33, the passing speed by the migration means 54 of a blade 29 rises to the location p5 defined beforehand, and it is maintained at a rate v3 to the location p6 of the lowest style edge which meets in the migration direction 31 of a periphery 33 from that location p5 or subsequent ones. The passing speed which meets in the migration direction 31 of this blade 29 is set to $v2<v1<v3$. Moreover, from a location p4 to a location p41, the flow rate of the water from a nozzle 43 decreases from a flow rate q2 to q3, and is maintained at the fixed flow rate q3 after that $(q1=q2>q3)$.

[0044] Passing speed of the migration direction 31 of a blade 29 is made more nearly high-speed than the semiconductor chip formation section 34 at a periphery 33 $(v1<v2)$, and working capacity is raised so that dicing may be completed as much as possible by this for a short time in the state of effect with small loads, such as clogging to the blade 29 in a periphery 33. Moreover, by the periphery 33 of the downstream of the migration direction 31, it supposes that it is more nearly high-speed than the semiconductor chip formation section 34 $(v2<v1<v3)$, and controls that a semiconductor chip 35 and the piece 36 of an edge exfoliate from the wafer sheet 22 with the cut water from a nozzle 43 by this. After the cut of this semiconductor chip formation section 34, at the time of the cut of the periphery 33 of the migration direction 31 downstream, the flow rate q3 of the cut water shown in drawing 2 (3) is decreased $(q2>q3)$, and exfoliation of the semiconductor chip 35 in this periphery 33 neighborhood and the piece 36 of an edge is prevented. In this way, according to this invention, a dicing activity can be done automatically, without exfoliating a semiconductor chip 35 and the piece 36 of an edge from the wafer sheet 22.

[0045] In a periphery 33, the bottom of the cut slot cut by the blade 29 becomes shallow in the migration direction, as shown by the reference mark 49 of drawing 1 . At a bottom 50, thickness d2 is maintained from the rear face 24 of the semi-conductor wafer 23.

[0046] When it is judged whether the line which should do other dicing activities which adjoin in the direction of y of the 1st dicing line 37 in step s8 exists and the next 1st dicing line exists, the above-mentioned steps s2-s7 are loop food ****. When the dicing activity of all the 1st dicing lines 37 is completed, in step s9, the angular displacement of the table 26 is carried out to the circumference of an axis 27, at step s10, along the 2nd dicing line 38, one by one, a blade 29 is used for a target and a dicing activity is done on him. The dicing activity of this step s10 is the same as the dicing activity of the above-mentioned steps s2-s7. In this way, if the dicing activity of all the 2nd dicing lines 38 is completed in step s11, all the dicing activities will be ended in step s12.

[0047]

[Effect of the Invention] Without damaging the semiconductor chip after dicing according to this invention, without increasing the adhesion on the rear face of a semi-conductor wafer of a wafer sheet, a wafer sheet to a semiconductor chip is selectively cut in the thickness direction from the front face of a semi-conductor wafer by the periphery by being stuck by the adhesion which is extent which can exfoliate at this time, and the part which is not cut in the thickness direction remains in a wafer sheet

side. Therefore, at the time of dicing, the semiconductor chip and the piece of an edge near a periphery can prevent certainly a possibility of exfoliating from a wafer sheet.

[0048] Rather than the periphery furthermore surrounded by the periphery, in the semiconductor chip formation section of the inner direction, it is cut deeply and cut by total thickness, this does not need to divide a semiconductor chip, and the chip of a semiconductor chip and a crack do not arise. In this way, while being able to abolish a possibility that it may exfoliate from a wafer sheet near a periphery, and a semiconductor chip and the piece of an edge may disperse, therefore being able to prevent breakage on a blade and being able to prolong the life of a blade, the productivity, workability, and yield of a semiconductor chip can be improved.

[0049] While according to this invention the thickness d2 left behind without cutting a periphery is chosen as 10-100 micrometers and this protects the exfoliation from the semiconductor chip in a periphery, and the wafer sheet of the piece of an edge, it becomes certain to prevent the chip of the semiconductor chip in near [the] a periphery and the piece of an edge and a crack.

[0050] According to this invention, by the periphery, while making passing speed v1 and v3 of a blade higher than the rate v2 in the semiconductor chip formation section, making still higher further passing speed v3 of the periphery of the migration direction downstream ($v1<v3$) and preventing certainly the exfoliation from the semiconductor chip in near the periphery of the migration direction downstream, and the wafer sheet of the piece of an edge in this way, dicing time amount can be shortened and productivity can be improved.

[0051] According to this invention, the flow rate of cut water can be decreased by the periphery in the migration direction downstream of a blade ($q1<q3$, $q2<q3$), and this can protect further much more certainly exfoliation of the semiconductor chip near [the] a downstream periphery, and the piece of an edge.

[0052] Without the piece of an edge a semiconductor chip and near a periphery exfoliating from a wafer sheet according to the semi-conductor wafer structure of this invention Moreover, a periphery folds and divides a semi-conductor wafer in the thickness direction in the part to which the cut was left behind, and the piece of an edge is made small. The wafer sheet which can simplify a consecutive routing, for example, can be elongated can be expanded, and spacing of the semiconductor chip on a wafer sheet can be made into homogeneity, for example, improvement in the workability of die bond etc. can be aimed at.

[0053] A dicing activity can be done automatically, without according to the dicing equipment of the semi-conductor wafer of this invention, a semiconductor chip's not exfoliating from a wafer sheet in the dicing, and the piece of an edge of a periphery exfoliating a semi-conductor wafer from a wafer sheet.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the simplified sectional view showing the configuration of one gestalt of operation of this invention.
[Drawing 2] It is drawing for explaining the actuation which carries out the dicing of the semi-conductor wafer 23 with a blade 29.
[Drawing 3] It is the sectional view of a vertical seen from cutting plane line III-III of drawing 2 (1).
[Drawing 4] It is the block diagram showing the electric configuration of the dicing equipment 21 of the semi-conductor wafer of one gestalt of operation of this invention shown in drawing 1 - drawing 3 .
[Drawing 5] It is a flow chart for explaining actuation of the processing circuit 52 shown in drawing 4 .
[Drawing 6] It is the sectional view showing the dicing process of the 1st advanced technology.
[Drawing 7] It is the top view of the semi-conductor wafer 2 in the 1st advanced technology shown in drawing 6 .
[Drawing 8] It is the sectional view which other 2nd advanced technology which solves the trouble of the full dice method shown in drawing 6 and drawing 7 simplified.
[Drawing 9] It is the top view simplified for explaining the 3rd advanced technology.
[Description of Notations]
21 Dicing Equipment of Semi-conductor Wafer
22 Wafer Sheet
23 Semi-conductor Wafer
24 Rear Face
25 Semi-conductor Wafer Structure
29 Blade
31 The Migration Direction
33 Periphery
34 Semiconductor Chip Formation Section
35 Semiconductor Chip
36 Piece of Edge
37 37a The 1st dicing line
38 2nd Dicing Line
41 Periphery Section
42 Front Face
43 Nozzle
52 Processing Circuit
53 Revolution Driving Means
54 Migration Means
55 Height Displacement Means
56 Angular-Displacement Means
57 Flow Control Valve

[Translation done.]

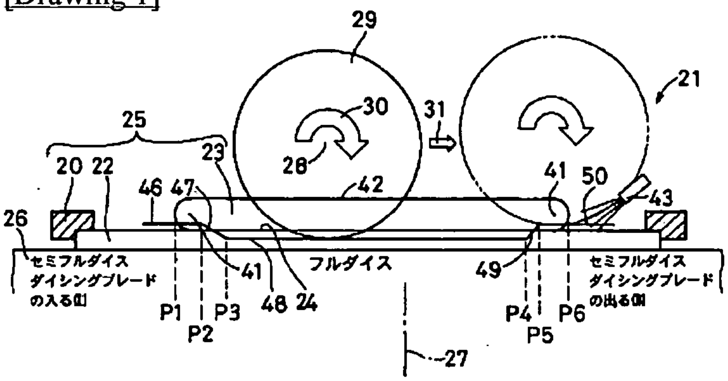
* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

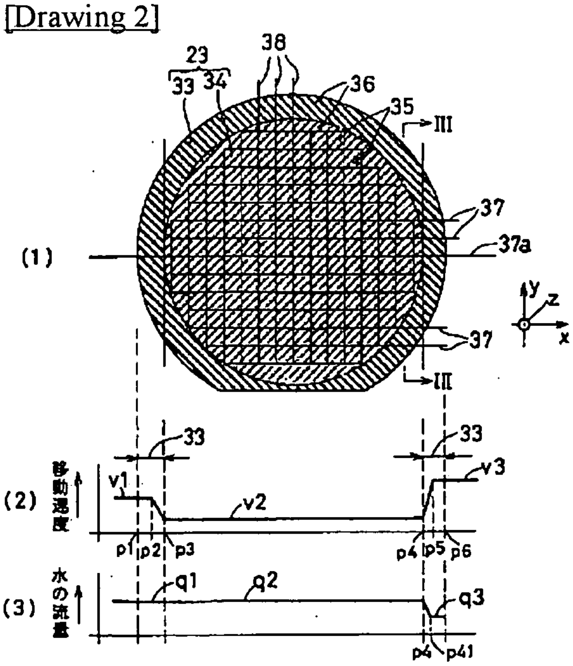
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

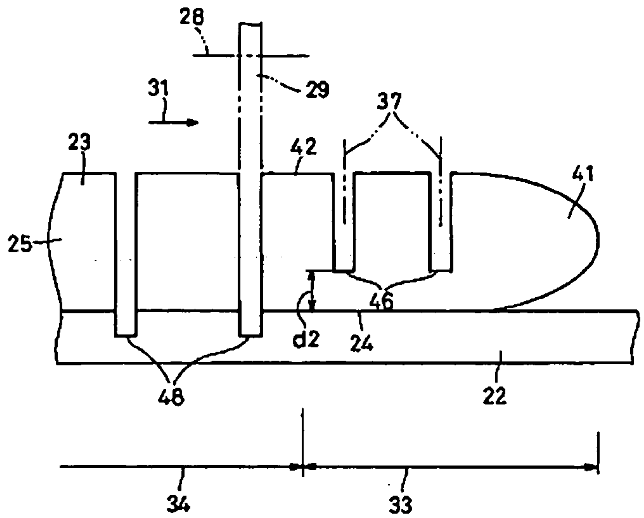
[Drawing 1]



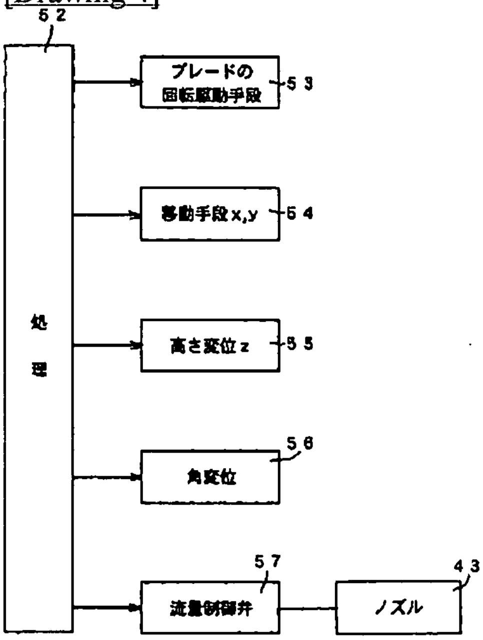
[Drawing 2]



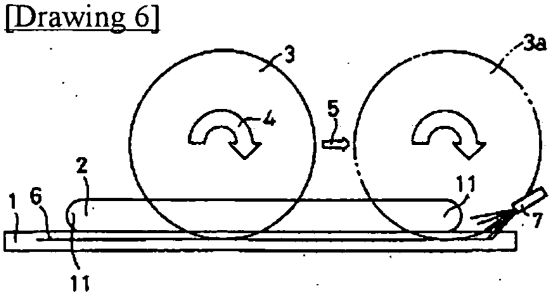
[Drawing 3]



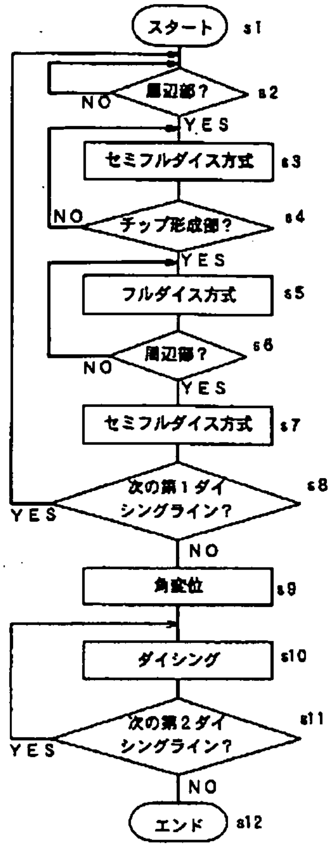
[Drawing 4]



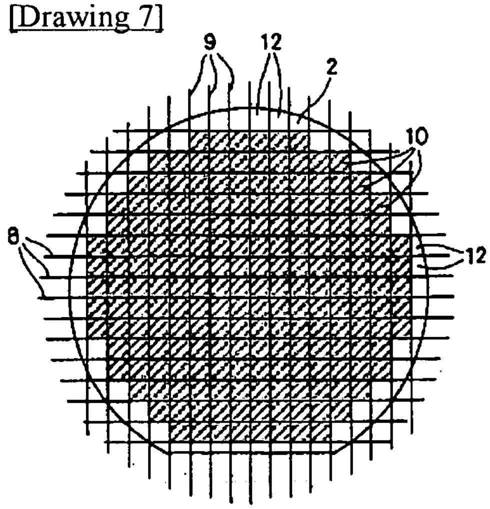
[Drawing 6]



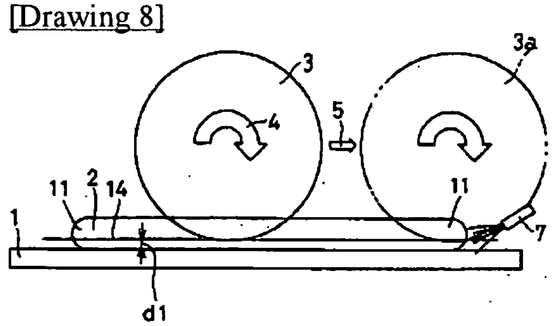
[Drawing 5]



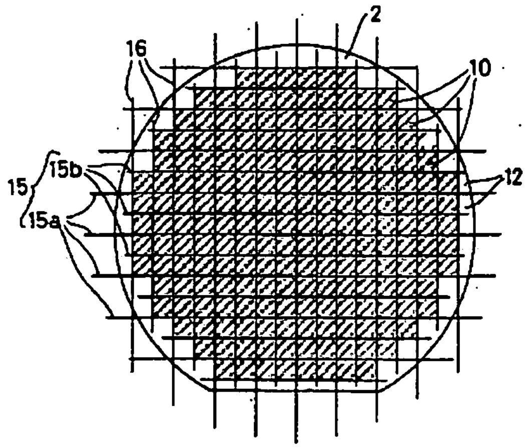
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]